Remarks

Claims 1-16 are pending in this application. Applicants have amended claims 1, 2, 9 and 10 to clarify the claimed invention. Applicants respectfully request favorable reconsideration of this application.

Applicants have amended claims 1 and 9 to recite that the digital representation of the object is divided into rows and columns, which was previously recited in claim 2. Applicants have also amended claims 1 and 9 to recite that information regarding the digital representation information on a geometric profile of the object is read out by detecting a position of the reflection of the incident light in a given column on the imaging sensor, which is described in paragraph 0030, lines 6-8 of the published application. Furthermore, Applicants have amended claims 1 and 9 to recite that information on the light scattered in the object in the direction of movement in a predetermined area around the profile is read out by studying a shape of the digital representation of the incident light over a number of sensor rows, as described at paragraph 0030, lines 2 and 3 of the published application. Dividing the digital representation into rows and columns, reading out geometric profile information by detecting a position of a reflection of incident light in a given column on the imaging sensor, and reading out light scattering in the object based upon a shape of the digital representation of the incident light over a number of sensor rows make it possible to simultaneously read out the geometry and scattered light simultaneously.

The Examiner rejected claims 1, 8, 9, 13, 14, and 16 under 35 U.S.C. § 103(a) as being

unpatentable over U.S. patent 4,984,172 to Luminari in view of Canadian patent 2,335,784 to Varghese et al. The Examiner rejected claims 2, 7, 10, and 15 under 35 U.S.C. § 103(a) as being unpatentable over Luminari in view of U.S. patent 4,168,489 to Ervin. The Examiner rejected claims 3-6, 11, and 12 under 35 U.S.C. § 103(a) as being unpatentable over Luminari in view of Ervin and further in view of U.S. patent 5,490,100 to Kableshkov.

The combination of Luminari and Varghese et al. does not suggest the invention recited in independent claims 1 and 9 since, among other things, the combination does not suggest Dividing the digital representation into rows and columns, reading out geometric profile information by detecting a position of a reflection of incident light in a given column on the imaging sensor, and reading out light scattering in the object based upon a shape of the digital representation of the incident light over a number of sensor rows. As previously set forth, Luminari does not disclose a method or apparatus for imaging characteristics of an object that includes detecting light scattered in an object simultaneously with light reflected by the object. Varghese et al. only suggests taking a picture of portions of pieces of wood and comparing the pictures to another to look at similarities and differences between the pictures to determine what type of wood the pieces are. Varghese et al. does not suggest measuring a geometrical profile of the pieces of wood. Therefore, neither Luminari nor Varghese et al. suggests simultaneous reading out of a geometric profile of an object and light scattered by the object.

The claimed invention divides the digital representation into rows and columns, reads out geometric profile information by detecting a position of a reflection of incident light in a given column on the imaging sensor, and reads out light scattering in the object based upon a shape of

the digital representation of the incident light over a number of sensor rows. Dividing out the digital representation into rows and columns and then analyzing the representation over the sensor array, permits the shape and light scattering to be determined. Reading out the light scattering information from the rows of the sensor array and analyzing the values for the rows permits the scatter information to be determined. Neither Luminari nor Varghese et al. suggests such a sensor, reading and analyzing information from such a sensor or the resulting simultaneous reading of geometric profile and reflected light.

According to the claimed invention, the position of the light detected by the imaging sensor is unknown on the rows and columns of the sensor. The invention can extract position of the light on the rows and columns in a region around the maxima. The position of the light may be used to calculate the three-dimensional geometric profile and the pixel values in the region around the maxima are used to calculate the scatter information. To reach this goal the information around the peak of the light on the sensor and the position of the light are extracted.

As discussed in paragraph 0026 of the published application, the claimed invention includes measuring with the sensor light that is both reflected by the object and scattered in the object. As described in the specification and illustrated in the drawings, the reflected and scatter light originate from a single source. As a result, the claimed invention can simultaneously measure different information from the reflected and scattered light in one area of the object.

The Examiner again asserts that Luminari suggests detects scattered light, referring to fig. 5 of Luminari. However, as described at col. 3, lines 3-16, Luminari clearly only detects

discolorations and physical defects on the surface of the material being sensed. Luminari clearly does not suggest detecting any light scattering by the object below the surface of the object, only at the surface.

With respect to claim 14, Luminari does not suggest a plurality of light sources. The Examiner cites col. 3, lines 25-55 of Luminari as suggesting multiple light sources. However, this passage does not relate to light sources. Rather, this passage relates the detection of the light-line in the sensor. The sensor includes an array of pixels, and thus the light is imaged onto discrete image points. Also, Luminari explicitly states that the light projector provides a line on the object. Therefore, Luminari does not suggest multiple light sources.

In fact, Luminari and Varghese et al. are not combinable because Luminari does not suggest scattered light in any way but, on the other hand, Varghese et al. does relate to scattered light. However, Varghese et al. only suggests measuring a picture of a surface of pieces of wood to determine a width of light pictured on the surface of the wood. Varghese does not suggest analyzing rows and columns of a digital representation of reflected and scattered light to determine geometric profile and scattered light information.

In view of the above, the combination of Luminari and Varghese does not suggest the invention recited in claims 1, 8, 9, 13, 14, and 16. Accordingly, the invention recited in claims 1, 8, 9, 13, 14, and 16 is not obvious in view of the combination of the combination of Luminari and Varghese. Consequently, Applicants respectfully request withdrawal of the rejection based on the combination of Luminari and Varghese.

The combination of Luminari and Ervin does not suggest the invention recited in claims 2 and 7, which depend from claim 1, or claims 10 and 15, which depend from claim 9, since, among other things, the combination of Luminari and Ervin does not disclose a method or apparatus for imaging characteristics of an object that includes detecting light scattered in an object simultaneously with light reflected by the object. Luminari does not suggest the invention as recited in claims 1 and 9 for the reasons discussed above. Ervin suggests a compression method applied to a word processing system to increase the amount of text displayed within a screen on a display.

With respect to the claimed invention, processing may operate in a row-by-row fashion. Determining a position typically does not require information from prior rows. Rather, the processing may be carried out using only information from the current row. However, to calculate the scatter information the shape of the laser around the position is typically required. Once the position is found it is known which rows contain relevant information for the scatter processing. A problem is that a peak position typically is not known until an entire image has been processed. At that point it would be necessary to store the entire image to be able to go back and find the relevant scatter information rows. The claimed invention utilizes compression to minimize the amount of data to save from each row for the scatter data extraction. According to the claimed invention, compression can reduce computational and bandwidth overhead. The prerequisites and targets are quite specific in this application. Conventional compression as described below may not the best solution to the problem.

Image compression is well known and many different methods are used depending on the application. Typically, it is desired to compress an image to reduce storage space or transmission bandwidth and subsequently to extract the relevant information from the compressed image. In normal image compression, the subsequent information extraction is an attempt to recreate the original image as well as possible, that is, to recreate the original image as well as possible. Ervin does not suggest classic image compression. Rather, Ervin has a different objective with the compression.

There are two general classes of image compression algorithms, destructive or non-destructive. In non-destructive compression the original can be recreated and in destructive compression algorithms the original image cannot be recreated exactly. Most common image compression methods are destructive and the most common example is JPEG compression typically used in consumer digital cameras and as a part of the coding of images on, for example, DVDs and BluRay discs.

Ervin suggests generating an image of a lower vertical (row) resolution to fit a page of text on a display with lower resolution than the resolution of the screen. The compression is made by a deterministic selection of rows from the original image. The horizontal scan is "compressed" by simply displaying points with a higher density on the screen to keep the aspect ratio of the characters. The compressed representation is only used for display and the original representation is still kept and used in further operations.

While Ervin suggests reducing the number of rows, the target is not the extract

information from the image which can be used as a relevant representation of the image. Instead Ervin suggests that the original image is still needed and maintained;.the compressed image is only used as an alternate and reduced view. Thus, Ervin does not suggest creating a compressed representation that can be used to extract relevant information instead of using the whole image.

Furthermore, Ervin suggests indiscriminately choosing a predetermined subset of image rows in the compression without any consideration of the information in any of the other rows in the image. This means that the vertical compression is simply a deterministic selection of rows from an image. This works well in the application suggested by Ervin in which the data in the image is predictable and certain features always appear in specific rows. This does not make any sense in an application where the relevant information appears in unknown positions, as in the claimed invention, which analyzes the row and columns to determine, for example, the shape of the digital representation.

Ervin does not suggest determining a maximum. Rather, Ervin suggests a row extraction that is a deterministic selection of rows. Along these lines, in Fig. 4B and Fig. 2 Ervin shows how the data from lines 0, 3, 5, 8 and 12 are chosen from the available rows 0-13 to represent the image in full page mode. In the example given in Fig 1-2 the result of a maximum operation would be the same as the extraction example. However, this is due to the fact that the rows are selected to be the representative rows where the character set have their discriminant information. At col. 2, lines 52-54, Ervin states, "The present invention accomplishes a reduction in the height of each character by utilizing electronic digital logic to select only 5 of the 14 rows of vertical dots . . . ." Significantly, Ervin uses the term "select" to describe the

operation, not a max or sum operation.

Still further, Ervin also does not suggest summation. Rather, Ervin only suggests selection. While Ervin may suggest digital circuitry, that is not the same as digital summation.

Accordingly, the combination of Luminari and Ervin does not suggest the invention recited in claims 2, 7, 10, and 15. It follows that the invention recited in claims 2, 7, 10, and 15 is not obvious in view of the combination of the combination of Luminari and Ervin. Therefore, Applicants respectfully request withdrawal of the rejection based on the combination of Luminari and Ervin.

The combination of Luminari, Ervin and Kableshkov does not suggest the invention recited in claims 3-6, 11, and 12 since, among other things, the combination does not disclose a method or apparatus for imaging characteristics of an object that includes detecting light scattered in an object simultaneously with light reflected by the object. As discussed above, the combination of Luminari and Ervin does not suggest the invention recited in claims 1 and 9. Providing the combination of Luminari and Ervin with the system suggested by Kableshkov would not overcome the above-described deficiencies of Luminari and Ervin.

Kableshkov does not suggest images or compression. Rather, Kableshkov suggests processing information in a data base. Databases are typically organized in rows and columns, but these are quite different concepts than the rows and columns in an image. Typically, each database column contains a specific information, for example, birth-year, name, income, postal

code, internet address, and are typically of different types, for example, integers, floating points, text. Each row then contains information on one object, for example, a specific person or company. The summation of information from different rows then gives the sum of, for example, the income for all persons in the database, or if only summing from specific rows the income of all individuals within a certain postal code. Kableshkov describes this at col. 1, lines 17-27. Thus, Kableshkov suggests fast sum data from data bases and has nothing to do with the creation of a compressed representation, which contains relevant information that can be used to recreate aspects of the original image. As stated at col. 1, line 30, the goal of Kableshkov is to create a "basis for deriving totals, averages and percentages".

With respect to analog summation, the Examiner appears to misunderstand two different meanings of the word "analog". According to the claimed invention, with respect to sensor data analog refers to the pixel information before analog-to-digital conversion (AD-conversion). This is discussed in paragraph 0033 of the published application.

On the other hand, Kableshkov suggests handling one floating point notation. Kableshkov states that other digital floating point formats with lower precision (lower number of bits) can be handled in an analogous manner by using a sub-set of the digital circuitry used for the full-precision operations. Here the meaning of "analogous" is clearly "in a similar manner", and has nothing to do with an analog representation of data as compared to a digital representation.

A database is typically fully digital. All data input all processing and all data output is

digital. A sensor system on the other hand initially creates a physical measurement which is typically analog. It can be the amount of charge (free electrons) created by incoming photons in a pixel. The A/D conversion then typically creates a digital representation where X electrons corresponds to one digital least significant bit of information. If analog summation is performed the charge from several pixels are collected (summed) before the AD conversion.

Therefore, the combination of Luminari, Ervin and Kableshkov does not suggest the invention recited in claims 3-6, 11, and 12. Accordingly, the invention recited in claims 3-6, 11, and 12 is not obvious in view of the combination of the combination of Luminari, Ervin and Kableshkov. As a result, Applicants respectfully request withdrawal of the rejection based on the combination of Luminari, Ervin and Kableshkov.

In view of the above, the references relied upon in the office action, whether considered alone or in combination, do not suggest patentable features of the claimed invention. Therefore, the references relied upon in the office action, whether considered alone or in combination, do not make the claimed invention obvious. Accordingly, Applicants request withdrawal of the rejections based upon the cited references.

In conclusion, Applicants respectfully request favorable reconsideration of this case and early issuance of the Notice of Allowance.

If an interview would advance the prosecution of this application, Applicants respectfully urge the Examiner to contact the undersigned at the telephone number listed below.

The undersigned authorizes the Commissioner to charge fee insufficiency and credit overpayment associated with this communication to Deposit Account No. 22-0261.

Respectfully submitted,

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